

Nutrition: A Primary Health Care Perspective

9

Authors:

Rina Swartⁱ

David Sandersⁱⁱ

Milla McLachlanⁱⁱⁱ

Abstract

Malnutrition impacts negatively on morbidity, mortality, educability and productivity. Notwithstanding the success reported in relation to the reduction of specific nutrient deficiencies such as folate and iodine, the overall nutritional status of the South African population has not improved over the last fourteen years. In reality, the double burden of disease has become more severe with the increased prevalence of micronutrient deficiencies (i.e. vitamin A and iron) together with high levels of overweight and obesity. The Integrated Nutrition Programme is located within a Primary Health Care framework, is based on internationally accepted 'best practice' and has a comprehensive set of interventions. Analyses of selected interventions suggest that implementation is sub-optimal. Inadequate human resources and lack of appropriate capacity have been identified as critical contributors to the lack of progress. Improvement in the nutrition situation will therefore require a concerted and coordinated effort to develop a range of capacities at different levels and within different cadres of health workers. These capacities and skills should not only be developed in-service, but should also be infused during training. In addition, further research into implementation is encouraged to assist in finding sustainable solutions for South African nutrition problems.

i Division Dietetics, University of the Western Cape

ii School of Public Health, University of the Western Cape

iii Full Circle Consulting

Introduction

This chapter focuses on nutrition as the outcome of interrelated causes in the domains of food, health and care in society. It includes both under- and over-nutrition in the term 'malnutrition'.

Malnutrition, particularly in early childhood, has both short-term and long-term effects impacting on educability, productivity, morbidity and mortality (see Figure 1).^{1,2} These effects perpetuate poverty and retard national economic development. Because so many people are affected, mild and moderate forms of malnutrition, though not highly visible, are of great public health significance.

The objectives of this chapter are to evaluate trends in the nutritional status of the South African population between 1994 and 2008,^a and review nutrition services within the South African health system in terms of Primary Health Care (PHC) principles.^b

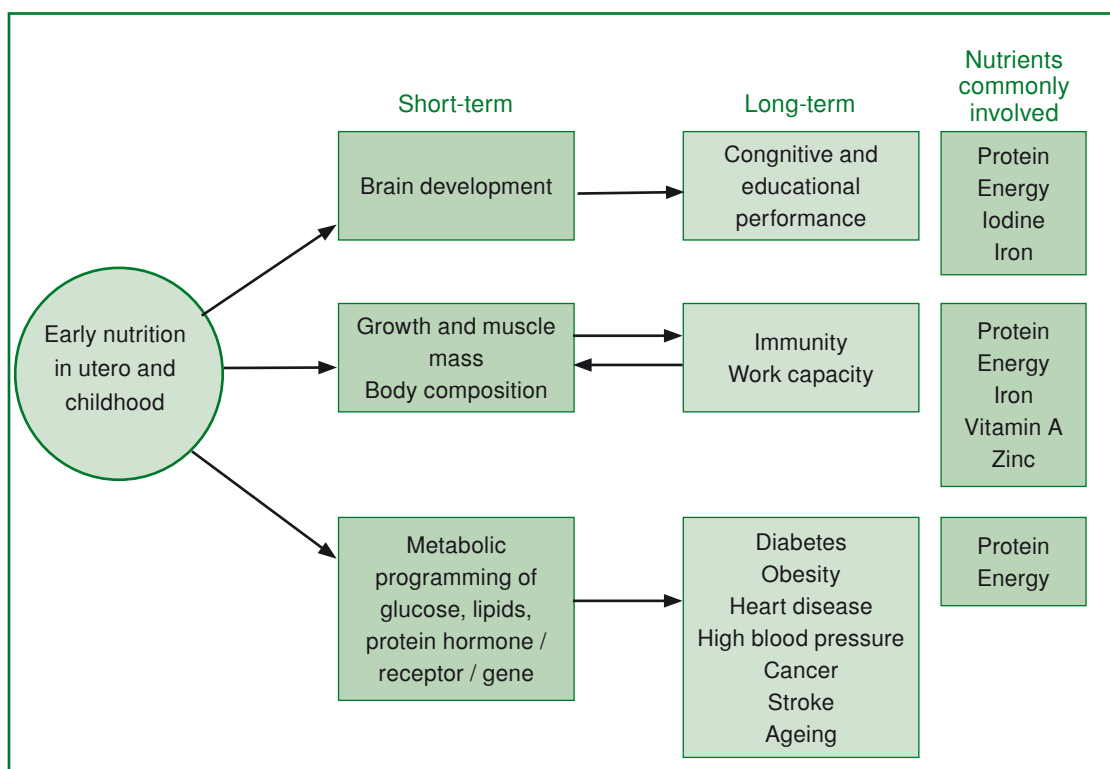
Causes of malnutrition

Nutritional status is the outcome of a complex combination of interrelated causes. The United Nations Children's Fund (UNICEF) has developed a conceptual framework that outlines in diagrammatic form the multiple causes of malnutrition operating at various levels in society.³ The precise weight of each of the many causative factors varies according to location and individual households.

The key assumptions of the conceptual framework are:

- nutritional status is an outcome of processes in society;
- malnutrition is a result of immediate, underlying and basic causes at different levels of social organisation;
- the necessary conditions for nutritional well-being (i.e. nutritional security) are access to adequate and safe food, adequate care of children and women, and access to basic health services, together with a healthy environment;

Figure 1: The short-term and long-term effects of early nutrition



Source: Adapted from Administrative Committee on Coordination / Standing Committee on Nutrition, 2000.²

- a The focus was on the trends between the findings of the national surveys conducted over this period including the 2005 National Food Consumption Survey – Fortification Baseline (NFCS-FB), which was only released at the end of September 2008. The above data was supplemented by information from publications of smaller studies, which were identified through a PubMed search.
- b The strategy employed to identify possible sources of information, includes a PubMed search for published material on nutrition strategies and / or implementation of nutrition programmes in South Africa. Due to a paucity of data on the above, information was supplemented by the identification of unpublished information through personal contacts and investigations.

- potential for fulfilling the necessary conditions (i.e. food, health and care) for nutritional security is determined by the availability and control of resources (i.e. human, economic and organisational);
- education and information influence the choice and use of resources in efforts to achieve the necessary conditions for nutrition security; and
- availability and control of resources (i.e. entitlements) are determined by previous and current technical and social conditions of production and political, economic and ideological / cultural factors (see Figure 2).

The conceptual framework assists in programme planning and implementation by guiding assessment, analysis and action in a specific context. In addition to guiding analysis of the causes of malnutrition and decisions to improve nutrition, the conceptual framework can also guide the design of information systems to enhance the quality of decision making.

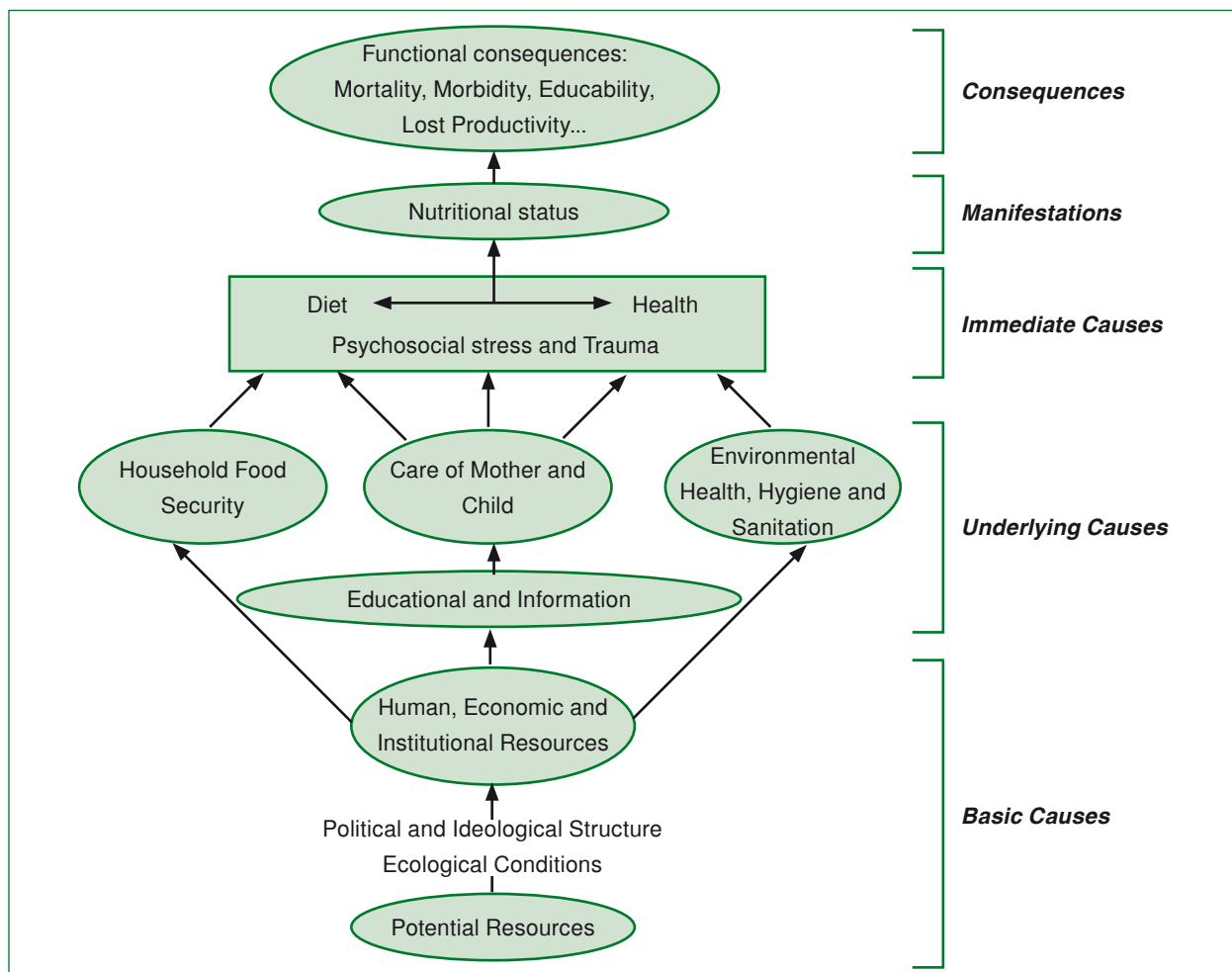
In the context of a broad PHC approach, the nutrition conceptual framework informed the South African Integrated Nutrition Programme (INP), when it was conceptualised and adopted after the first democratic elections in 1994.^{6,7} It is used in this chapter to evaluate trends in the nutrition situation in the country between 1994 and 2008, and to review nutrition services in the South African health system in terms of PHC principles.

Nutrition situation in South Africa

Children

Malnutrition continues to affect the lives of millions of children in South Africa. While some indicators show improvement, several conditions seem to have worsened over the past decade. In addition, children's nutritional status varies considerably among the nine provinces and possibly within each province. This has bearing on targeting and prioritisation for interventions and resource allocation.

Figure 2: Conceptual framework on nutrition



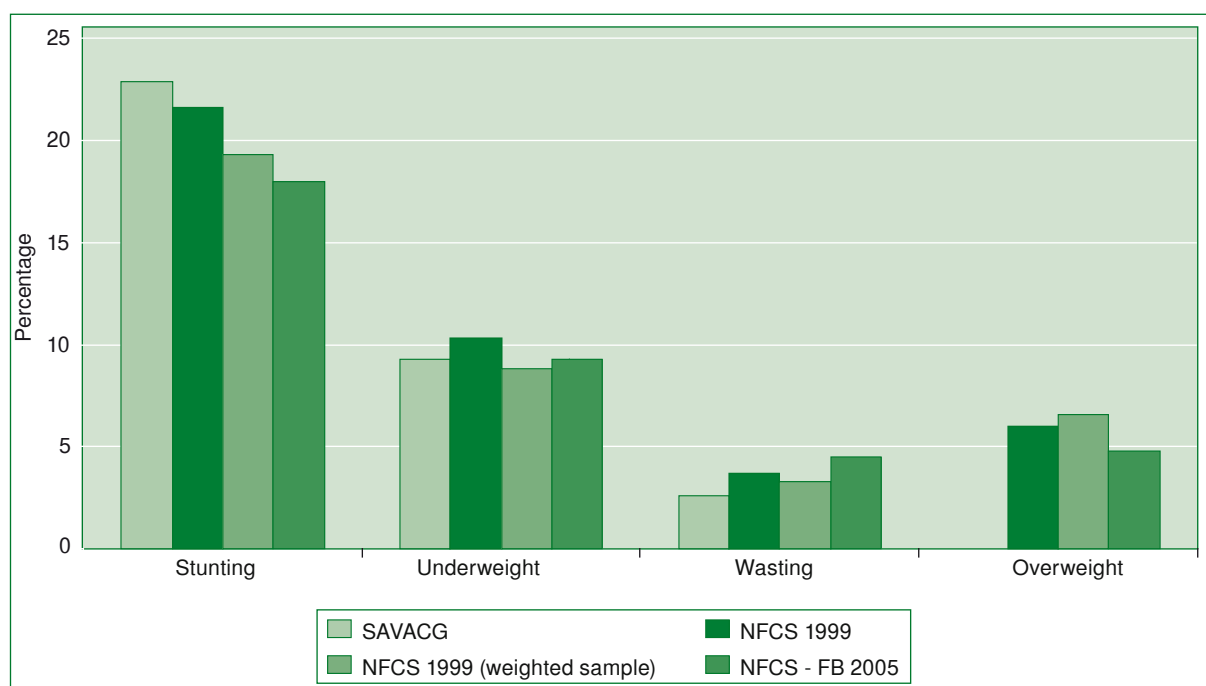
Source: United Nations Children's Fund, 1990;³ World Bank, 1994;⁴ Aguayo, 1999.⁵

Birth weight, an indicator of perinatal health, reflects both foetal growth and maternal well-being. The prevalence of low birth weight (i.e. a full-term baby weighing less than 2.5 kg at birth) in South Africa was estimated to be 16% in 2000 by the Saving Babies survey, with the highest rates (22%) recorded in the Northern Cape.⁸ These rates are above the estimated average of 11% in all developing countries, and considerably above the estimated 6% for industrialised countries.² The goal established by the 1990 World Summit for Children is to have less than 10% of children born with low birth weight.⁹

The 2005 National Food Consumption Survey - Fortification Baseline (NFCS-FB)^c reported that the national prevalences of stunting,^d underweight,^e and wasting,^f were 18%, 9.3% and 4.5% respectively (see Figure 3), which are marginally lower than in 1994 and 1999.¹⁰ Nationally, these indicators are at levels of low public health significance.

The prevalence of overweight in children is currently estimated at an 'acceptable' level of 5%.⁹ This reduced marginally in all areas between 1999 and 2005, but more markedly so in urban areas.¹⁰

Figure 3: Comparison of changes in anthropometric status of children in South Africa, 1994–2005



Note: Three nationally representative samples contribute to the nutritional status of young children: i) the South African Vitamin A Consultative Group (SAVACG) conducted in 1994 on a nationally representative sample of children 6-60 months; ii) the National Food Consumption Survey (NFCS) conducted in 1999 on a nationally representative sample of children 12-108 months; and iii) the National Food Consumption Survey – Fortification Baseline (NFCS-FB) conducted in 2005 on a nationally representative sample of children 1-9 years and women aged 16-35 years. The weighted sample of the NFCS 1999 has been corrected for the over sampling in poverty areas.

Source: South African Vitamin A Consultative Group, 1995;¹¹ Labadarios, 2000;¹² Steyn et al., 2005;¹³ Kruger et al., 2007.¹⁰

- c NFCS-FB is technically not a pre-fortification baseline as data collection took place a year after fortification of staples became mandatory. However, for some nutrients and for children older than six years and for women of childbearing age, this is the only nationally representative database on biochemical micronutrient status and is therefore regarded as a 'baseline'.
- d Height-for-age <-2 SD: The proportion of children with height-for-age under 2 standard deviations from the median height of the reference population.
- e Weight-for-age <-2 SD: The proportion of children with weight-for-age under 2 standard deviations from the median weight of the reference population.
- f Weight-for-height <-2 SD: The proportion of children with weight-for-height under 2 standard deviations from the median weight-for-height of the reference population.
- g Weight-for-height >+2 SD: The proportion of children with weight-for-height above two standard deviations from the median weight-for-height of the reference population.

Table 1: Anthropometric status (%) of children in South Africa by province, 1994, 1999 and 2005

Indicator	Year	EC	FS	GP	KZN	LP	MP	NC	NW	WC	SA
Stunting	1994	29	29	12	16	34	20	23	25	12	23
	1999	21	30	20	19	23	26	30	25	15	22
	2005	18	28	17	15	24	18	28	15	12	18
Underweight	1994	11	14	6	4	13	7	16	13	7	9
	1999	7	14	9	6	15	4	24	15	8	10
	2005	8	14	6	5	12	11	38	12	8	9
Wasting	1994	3	5	1	1	4	2	3	5	1	3
	1999	2	3	1	4	8	3	10	6	1	4
	2005	4	3	3	1	4	8	19	3	12	4
Overweight	1999	8	6	6	7	4	17	4	1	5	6
	2005	6	1	6	6	2	3	-	5	3	5

Note: Shaded areas in Table 1 indicate a prevalence of moderate to high public health significance according to World Health Organization (WHO) standards for stunting $\geq 20\%$, for underweight $\geq 10\%$ and for wasting $\geq 5\%$.¹⁴ Currently, there is no WHO classification available for overweight in children, but based on the statistical method used for determining levels for other indices, cut-off points similar to that of wasting is suggested.

Source: South African Vitamin A Consultative Group, 1995;¹¹ Labadarios, 2000;¹² Kruger et al., 2007.¹⁰

The biochemical status of children for selected micro-nutrients is now available for two points in time, 1994 and 2005 (see Table 2). With the exception of folate and iodine, the evidence suggests that children's micronutrient status has deteriorated since 1994.

According to the 2005 NFCS-FB, the vitamin A status of children has deteriorated significantly since 1994. The study found that only 38% of children had a mean serum vitamin retinol concentration greater than 20mg/dL, which is indicative of an adequate status.¹⁵ Severe vitamin A deficiency ($<10 \mu\text{g/dL}$) was recorded in around 15% of children. These findings are despite the legislated fortification of bread, flour and maize meal since 2003 and the national high-dose vitamin A supplementation programme implemented in most provinces since 2001.^{23,24} The inadequate vitamin A status appears to be similar across all age groups (1-9 years) with all provinces having a problem of severe public health significance ($\geq 20\%$ prevalence). The cause of the significant deterioration is unknown and should be investigated. The biochemical analyses of samples, for both the 1994 South African Vitamin A Consultative Group (SAVACG) and the 2005 NFCS-FB, were done by the same internationally accredited laboratory and validity of results is therefore assumed. An investigation into possible causes of the extreme deterioration in vitamin A status should not exclude an investigation into the assessment methodology used by the laboratories to confirm accuracy and comparability.

The iron status of children also appears to have deteriorated since 1994, although it does not reach levels of severe public health significance ($\geq 40\%$ prevalence) in any of the provinces. The 2005 NFCS-FB indicated that iron deficiency is a greater problem in younger children.²¹

The levels of zinc deficiency found in the 2005 NFCS-FB, range between 27.3% and 58.5%.²² According to Hotz and Brown a prevalence of serum zinc deficiencies greater than 20% calls for national nutrition interventions.¹⁸ No folate deficiency and minimal iodine deficiency were found amongst children aged 1-9 years.^{25,19} On the contrary, iodine status needs to be monitored carefully where the iodine status of children has reached excessive levels (specifically the Northern Cape).¹⁹

Dietary intake and the prevalence of infectious diseases contribute to children's nutritional status. Exclusive breastfeeding is a child's first defence against malnutrition and death.²⁶ In most countries and regions, breastfeeding initiation is high. However, exclusive breastfeeding is not widely practised and South Africa is no exception. Exclusive breastfeeding is relatively uncommon. According to the 1998 and 2003 South Africa Demographic and Health Surveys (SADHS) it was estimated that between 10% and 12% of infants younger than four months were exclusively breastfed.²⁷⁻³⁰ Furthermore, whereas the national policy advocates exclusive breastfeeding up to six months of age, it is estimated that only 4% of infants are still exclusively breastfed by the age of six months.³¹⁻³⁵

The 1999 NFCS indicated that the dietary intake of children is inadequate in energy, all micronutrients and fibre.¹² The Birth-to-Twenty study of a cohort of 143 urban Blacks, which started in 1990, suggests that dietary quality has deteriorated over time. It confirmed findings of the 1999 NFCS that the inadequate dietary intake observed is a reflection of the lack of variety in the diet, the infrequent consumption of fruit, vegetables and milk, and the daily consumption of a large variety of miscellaneous foods, frequently with sugar.³⁶

Table 2: Proportion (%) of children with insufficient biochemical status in South Africa by province, 1994 and 2005

Indicator		EC	FS	GP	KZN	LP	MP	NC	NW	WC	SA
Inadequate Vitamin A status <20µg/dL	1994	31.1	26.8	23.5	38.0	43.5	33.0	18.5	32.0	21.0	33.3
	2005 1-5yrs	69.1	61.6	68.8	93.0	74.5	57.1	33.4	52.7	45.0	65.1
	2005 1-9yrs	64.2	61.7	65.2	88.9	75.7	52.1	23.0	49.6	43.5	63.6
Vitamin A deficiency (severe) <10µg/dL	2005 1-9yrs	8.2	11.3	11.2	44.7	12.5	4.2	3.8	5.8	2.3	13.7
Anaemia Hb<11g/dL ≤60 months Hb<11.5g/dL >60 months	1994	20.6	17.1	16.3	10.4	34.2	27.7	21.5	24.5	28.6	21.4
	2005 1-9yrs	30.3	22.0	26.6	21.7	34.1	25.0	11.1	28.1	38.0	27.9
Iron depletion Hb≥11g/dL or 11.5 for >60 months and ferritin <12µg/L	1994	2.0	2.9	5.2	10.7	1.5	4.7	4.4	3.3	8.2	4.8
	2005 1-5yrs	1.2	24.2	5.8	5.2	7.3	4.7	12.5	10.1	8.8	7.8
	2005 1-9yrs	1.2	18.9	4.8	3.6	5.3	4.5	5.6	6.9	7.5	5.7
Iron deficiency Hb<11g/dL or 11.5 for >60 months and ferritin <12µg/L	1994	2.4	3.9	3.8	3.5	9.1	7.0	6.5	5.0	8.2	5.0
	2005 1-5yrs	8.4	16.1	10.4	11.3	13.8	11.6	-	8.7	12.0	11.3
	2005 1-9yrs	4.8	11.6	7.1	5.9	11.8	7.9	-	5.2	9.4	7.6
Zinc deficiency <65µg/dL	2005 1-9yrs	35.0	43.9	36.7	-	27.3	27.3	-	41.1	58.5	45.3
Iodine deficiency % urinary iodine <20µg/L	2005 1-9yrs	1.5	-	0.3	-	-	0.7	-	4.6	-	0.7
Iodine excess % urinary iodine ≥300µg/L	2005 1-9yrs	30.7	53.8	25.8	44.4	33.6	24.3	95.0	27.6	34.5	33.6

Note: Shaded areas indicate prevalence at a level of high public health significance according to international standards for vitamin A (≥20%), iron (≥40%), iodine (≥20%) and zinc (≥20%).¹⁵⁻¹⁸

Source: South African Vitamin A Consultative Group, 1995;¹¹ Labadarios, 2000;¹² Jooste et al., 2007;¹⁹ Labadarios et al., 2007;²⁰ Labadarios and Louw, 2007;²¹ Dhansay et al., 2007.²²

Adolescents

Little information is available on the nutritional status of adolescents in South Africa. The 2002 National Youth Risk Behaviour Survey indicated that 17% of youth were overweight (BMI>25) and 4.2% were obese (BMI >30).³⁷ The trend towards higher rates of overweight and obesity is confirmed by reported rates of overweight in the age group 16-24 years. The 2003 SADHS reported 31.2% overweight among women in this age group, whereas the 2005 NFCS-FB reported a rate of 42.2%.¹⁰ A lack of physical activity and poor dietary patterns are the main contributors

to the overweight trend in adolescents. According to the 2002 National Youth Risk Behaviour Survey, 38.5% of youth engage in insufficient physical activity, with 25% watching more than three hours of television per day.³⁷ A study in Cape Town schools revealed that unhealthy foods brought to school outnumbered healthy ones by two to one with 70% of at-school purchases being unhealthy food items.³⁸ Neither better knowledge, nor higher socio-economic status contributed to the likelihood of purchasing healthy foods at school by these school children.

Adults

Underweight in men and women is relatively uncommon with 4.6% of women and 8% of men having a BMI <18.5.^{10,27} In contrast, 50% of young women and 30% of young men (age 16 to 35 years) are overweight or obese.^{10,27,28} The problem is particularly acute in urban areas.

Contributing factors to the levels of overweight in adults are a lack of physical activity and dietary patterns. A national survey in South Africa by the World Health Organization (WHO) in 2002/03 indicates that less than one in three of the adult population meet the international requirements for health enhancing physical activity (at least 30 minutes of accumulated physical activity per day for every day of the week).³⁹ The dietary changes resulting in diets that are too high in fat and saturated fat (from animal products), too low in fruit and vegetables, too high in salt, sugar and refined carbohydrates and too low in fibre has been related to urbanisation.⁴⁰ The consumption of an unhealthy diet is currently one of the most important causes of chronic diseases, together with a lack of physical activity and long-term use of tobacco products, which is currently the third leading cause of premature years of life lost, especially in the age group 35-64 years.⁴¹ Due to the rapid epidemiological transition the poor are becoming the most vulnerable victims of these chronic diseases.⁴²

Information on the biochemical micro-nutrient status of women in South Africa is based on the 2005 NFCS-FB. Vitamin A deficiency in women mirrors that of children, although at a lower level with 27.2% of women having an insufficient vitamin A status (<20µg/dL).²⁰

Although severe iron deficiency was uncommon, iron depletion (Hb >12, ferritin ≤15) was present in 7.7% of women and iron deficiency (Hb <12, ferritin <15) was present in 10.5% of women.²¹ Anaemia (Hb <12g/dL) was present in 29.4% of women and does not represent a severe public health problem (i.e. less than 40% prevalence), although significant provincial differences have been observed with KwaZulu-Natal and Limpopo having the biggest problem (37%).¹⁶ Overall anaemia in South African women is a bigger problem than in America and Europe (18% and 19% respectively) but lower than the estimated prevalence in Africa (48%).¹⁶

As with children, the folate and iodine nutritional status of women appears to be optimal. No data on zinc status of adults has been published since 1994.^{25,19}

Elderly

The elderly population is not well researched. According to the 1998 and 2003 SADHS, overweight in elderly men and women is similar to that of adult men and women.^{27,28}

Hunger

Despite the findings on increasing overweight within the South African population at large, hunger persists. The 2005 NFCS-FB found 51% of households reported experiencing hunger, with another 28% at risk of hunger.⁴³ This is in stark contrast with the 2006 General Household Survey findings suggesting that hunger has been decreasing with only 6% of households experiencing hunger.⁴⁴ These contradictory findings indicate a need to standardise food security and hunger indicators, as well as the need for further investigations into contributing factors.

South Africa's nutrition strategies in a Primary Health Care framework

The extent of the problem of chronic malnutrition (including both under- and over-nutrition) in South Africa suggests that action is needed at all levels of causation as summarised in the conceptual framework (in Figure 2). From a PHC perspective, the situation requires a set of comprehensive actions, which span therapeutic intervention (i.e. treatment), rehabilitation, disease prevention and health promotion, with an emphasis on the social determinants of nutritional health. Documenting the impact of broader political and economic forces on the health and nutritional status of the population served, working cooperatively with other sectors and the communities involved, raising awareness of local and global issues impacting on food production and supply, and advocating for policy change in relation to these issues are essential aspects of comprehensive PHC. Examples of elements of a comprehensive PHC approach that would address the immediate, underlying and basic causes of malnutrition, to ensure adequate and health-promoting nutrition are provided in Table 3. Promotive strategies focus on addressing underlying and basic causes of malnutrition and often involve intersectoral actions and public health policies, including sectors such as trade and agriculture. Preventive strategies focus on addressing immediate levels of causation as well as underlying causes. Therapeutic and rehabilitative strategies focus on addressing the immediate levels of causation. In the section that follows, the INP is assessed in light of the PHC framework and the nutrition conceptual framework introduced earlier.

Table 3: Categorisation of nutrition strategies within a Primary Health Care framework to ensure adequate and health promoting nutrition

Promotive
<ul style="list-style-type: none"> ◆ Nutrition advocacy to policy makers (including technical support to other sectors). ◆ Control of nutrition and food related advertising / promotions / communication such as television and printed media (e.g. paypoint promotions, advocacy against advertising of high fat and sugar foods to children). ◆ *Growth monitoring and promotion (including community-based activities). ◆ Community involvement in exploration of causes of food insecurity. ◆ *Breastfeeding promotion. ◆ Enforcement of the Code on marketing of breastmilk substitutes. ◆ Advocacy for improved maternity benefits to facilitate breastfeeding. ◆ Quality control of food. ◆ Community-based monitoring of food prices / stock. ◆ Promotion of sustainable agricultural production (e.g. production of micronutrient rich foods, traditional foods, community gardens, farmers markets). ◆ Advocacy against policies that reduce control of local farmers and increase power of transnational food corporations. ◆ Government regulation of food industry in terms of labelling and marketing. ◆ Advocacy and legislation for provision of safe water and sustainable sanitation. ◆ Advocacy for adequate income support to buy food. ◆ Food pricing policies (subsidies on basic foods, zero rating of VAT on food, food price control, subsidisation of agricultural production). ◆ Taxation of alcohol and tobacco products. ◆ Taxation that favours food. ◆ Insecure households.
Preventive
<ul style="list-style-type: none"> ◆ Breastfeeding promotion. ◆ Lactation support and management. ◆ Prevention of mother-to-child transmission (PMTCT) of HIV. ◆ Nutrition education (including school curriculum), communication and promotion on healthy diets and health risks associated with poor nutrition. ◆ Food fortification. ◆ Prophylactic micronutrient supplementation of at risk groups (children, women, elderly). ◆ *Growth monitoring and promotion (including community-based activities). ◆ Detection of growth faltering. ◆ Promote / referral to immunisation and parasite control. ◆ Food provision such as school feeding, feeding schemes, soup kitchens. ◆ Appropriate menus / diets in hospital paediatric wards.
Therapeutic
<ul style="list-style-type: none"> ◆ Treating malnourished children (community- and hospital-based). ◆ Management of nutrition (counselling and support) during illness (e.g. diarrhoea, diabetes). ◆ Continued feeding (breastfeeding and soft nutrient dense food) during illness such as diarrhoea. ◆ Supplementation (micro-nutrients) of nutritional deficiencies. ◆ Dietary modification during illness (e.g. weight reduction, diabetics).
Rehabilitative
<ul style="list-style-type: none"> ◆ Management of nutrition during recovery from illness such as rehabilitation centres or community-based management of malnourished children, monitoring of illness related dietary modification, continued (additional) feeding after illness such as diarrhoea to ensure catch-up growth.

Note: * These strategies are relevant as promotive and preventive actions.

Source: Developed by authors.

The INP is situated within the Maternal, Child and Women's Health Cluster of the Strategic Health Programme Branch of the Department of Health (DoH). The INP has three main components: health facility-based nutrition programmes and strategies; community-based nutrition programmes and strategies; and nutrition and HIV and AIDS support programmes and strategies. The nutrition strategies and strategic objectives of the INP, as well as nutrition relevant strategies that exist within other government departments are outlined in Table 4.

The most important changes to the INP during the past five years include the following.

- The Nutrition Directorate assuming responsibility for providing technical support in other sectors, such as Social Development and Agriculture, to more effectively address household food security.
- School feeding becoming the responsibility of the Department of Education.
- Objectives regarding growth monitoring and breastfeeding addressed through the Integrated Management of Childhood Illnesses (IMCI) programme.
- Actions to address under-nutrition, such as appropriate feeding during illness are explicitly stated in the programme objectives.
- Objectives related to HIV and AIDS, specifically within the context of breastfeeding promotion added.
- Objectives to support international strategies, customised to the South African context, such as the Baby-Friendly Hospital Initiative (BFHI) and the Food Based Dietary Guidelines (FBDG) added.
- More attention given to nutrition information.

Critical assessment of nutrition strategies in South Africa

A comparison of Table 3 and Table 4 demonstrates that nutrition-related policies and strategies in South Africa are reasonably adequate and comprehensive in terms of PHC principles. This is to be expected as the PHC approach informed the conceptualisation of the INP.⁵⁰ The reasons for the stagnant, if not deteriorating nutritional situation in the country should, therefore be investigated through a review of the implementation of selected critical nutrition strategies. These include breastfeeding promotion, growth monitoring and promotion, food fortification, micronutrient supplementation, hospital-based management of severe malnutrition, community-based nutritional rehabilitation and nutrition management during illness.

Breastfeeding promotion

A combination of strategies to promote, protect and support breastfeeding is necessary to improve the current low prevalence of exclusive breastfeeding (10% by age three months).³⁰ To this effect South Africa has adopted the Baby Friendly Hospital Initiative, but currently only 29.2% of hospitals with maternity beds meet the criteria.^{51,52}

The International Code on Marketing of Breast Milk Substitutes has been adopted by South Africa since 1995, and comprehensive draft legislation has been prepared, which includes all provisions, articles and subsequent resolutions of the original 1981 WHO Code.^{33,53} Unfortunately, the delay in the final legislation of the Code is not in the interest of the protection of breastfeeding. When the code is finally legislated and implemented, it will have far reaching implications for the products included in existing intervention programmes such as the Nutrition Supplementation Programme. Current maternity leave benefits are still inadequate to meet the needs of breastfeeding mothers.^{33,54,55}

Discouragement of breastfeeding is used as an option to reduce mother-to-child transmission of HIV.⁵³ This impacts negatively on breastfeeding initiation, exclusivity and duration by women who are HIV-negative.^{33,56-58} Intensive training in accordance with the national breastfeeding guidelines for health workers, combined with ongoing peer support is required to prevent breastfeeding being undermined by the HIV pandemic.^{59,60}

Growth monitoring and promotion

Growth monitoring and promotion has been used internationally as one of the first steps in early identification and prevention of growth faltering. Modest beneficial effects have been observed, where growth monitoring and promotion has been used as a vehicle for community-based nutrition education and counselling that involve carers, community health workers and community representatives.⁶¹ Schoeman et al. have however highlighted the numerous gaps in the implementation of growth monitoring and promotion within the South African context.⁶² These include: inaccurate assessment of weight of children; failure to plot weights; the inability of nursing staff to identify the nutritionally at risk; poor utilisation of the Road-to-Health card; and poor communication with caretakers.^{62,63} Particular groups, such as farm workers, whose children have been identified as nutritionally at greatest risk, might also have limited access to this service.¹²

Table 4: Key governmental nutrition relevant strategies within South Africa

Sector	Nutrition strategy	Focus area	Strategic objectives
Department of Health, Nutrition Directorate	Technical support to other sectors Develop support systems <i>[Nutrition education, promotion and advocacy]</i> <i>[School feeding]</i> <i>[Improve nutritional management]</i> <i>[Intersectoral action]</i>	Contribution to household food security (HHFS)	To ensure that other sectors dealing with HHFS receive adequate technical nutrition support <i>[To alleviate short term hunger among primary school pupils]</i>
	Nutrition support and counselling during disease and recovery using nutrition protocols and guidelines Strengthen nutrition activities through IMCI <i>[Growth monitoring]</i> <i>[Promotion / support of breastfeeding]</i> Nutrition education Dietary modification Management of malnutrition (moderate and severe) Appropriate feeding during illness and recovery Implement Food-based dietary guidelines <i>[Improved nutritional management]</i> <i>[Intersectoral action]</i> <i>[Follow-up actions]</i> <i>[Referrals]</i> <i>[Support groups]</i>	Disease specific nutrition support, treatment and counselling	To decrease the prevalence of low birth weight, underweight in infants and underweight in pregnant / lactating women To reduce all forms of severe malnutrition (underweight, wasting, stunting) To decrease malnutrition in children <5 years To decrease mortality rate of children <5 years To decrease nutrition-related disease of lifestyle (obesity, coronary heart disease, hypertension, and type 2 diabetes) To decrease communicable and infectious disease To decrease chronic debilitating diseases
	Provision of growth cards to all <i>[caregivers]</i> children <2 years Regular growth monitoring through measurement, recording and interpretation of child growth Detection of growth faltering and malnutrition Counselling of caregivers Promotion of growth Strengthen growth monitoring and promotion through IMCI	Growth monitoring and promotion	To prevent / decrease growth faltering in children 0-24 months To ensure all new babies receive a growth card
	Nutrition education Nutrition promotion Nutrition advocacy	Nutrition promotion, education and advocacy	To improve awareness of the INP and nutrition in general
	Baby-Friendly Hospital Initiative Implementation of the code of marketing breast milk substitutes Lactation management Provision of support and information to caregivers Prevention of mother to child transmission (PMTCT) <i>[Nutrition education, promotion, and advocacy]</i> <i>[Support groups]</i>	Promotion, protection and support of breastfeeding	To increase exclusive breastfeeding for six months To increase the percentage of mothers who breastfeed up to 24 months with appropriate complementary foods To ensure that mothers who do not breastfeed, practice appropriate replacement options To ensure that health facilities with maternity beds are baby-friendly
	Dietary diversification Micronutrient supplementation Food fortification Supporting / promoting agricultural interventions to increase availability of micronutrient rich foods Quality control of food Linkages with other public health measures (i.e. immunisation and parasite control)	Micronutrient malnutrition control	Eliminate micronutrient deficiencies (focus on vitamin A, iron and iodine) Decrease the proportion of children with an intake of vitamins and minerals below the recommended levels To increase the proportion of households consuming iodized salt
	Provision of meals in public institutions Maintaining food service systems in public institutions Technical support to dieticians in public institutions	Food service management	To ensure adequate and culturally acceptable meals to clients in public institutions
	Surveys Surveillance Management information Monitoring Evaluation Research Use of District Health Information System	Nutrition information systems	To assess the nutritional status of the population through regular surveys To collect, utilise and monitor specific indicators Implement a minimum data set
	Recruitment Placement , performance and management of staff Capacity building and training	Human Resource Plan	To develop and implement the INP human resource plan To ensure that staff complete the induction and in-service training

Sector	Nutrition strategy
Department of Education	<ul style="list-style-type: none"> ◆ National School feeding programme
Department of Social Development	<ul style="list-style-type: none"> ◆ Social Assistance (old age, disability, war veterans) ◆ Social relief of distress (short term relief programme) ◆ Child grants (foster child, care dependency, child support grant)
Department of Finance	<ul style="list-style-type: none"> ◆ Zero-rating of VAT on food (currently 19 items) ◆ Taxation of alcohol and tobacco products ◆ Level of tax relief to individuals (raised to R6 000 in 2008) ◆ Agricultural Subsidies ◆ Subsidisation of foodstuffs (currently none) ◆ Import / export regulations and trade agreements
Department of Agriculture	<ul style="list-style-type: none"> ◆ Poverty Alleviation Programme (i.e. food gardens) ◆ Land Redistribution Programme
Department of Environmental Affairs	<ul style="list-style-type: none"> ◆ Monitoring of quality of food ◆ Monitoring fortification levels of mandatory fortified foods

Note: Additions to the INP indicated in **bold**, whilst deletions are indicated in *[italics]*.

Sources: Department of Health, 2008;⁴⁵ Labadarios et al., 2005;⁴⁶ Department of Social Development, 2004;⁴⁷ South African Social Security Association, 2008;⁴⁸ Alderman and del Ninno, 1999.⁴⁹

Food fortification

The effectiveness of food fortification has been demonstrated in small intervention studies in South Africa using complementary foods and maize meal.^{64,65} However, currently it would appear that the mandatory fortification programme since 2003, combined with the micronutrient supplementation programme, has not been as successful as anticipated.^{23,24} A number of research studies have postulated reasons for the lack of success of food fortification.⁶⁶⁻⁶⁸ In addition to contributing to high morbidity and mortality and lower learning capacity, poor micronutrient status could also contribute to lower weight gain by infants, and thus contribute to the unchanged anthropometric status of children.⁶⁹

Folate fortification, which is at much higher levels within the fortification mix, seems to have eradicated any folate deficiencies and effected a reduction in neural tube defects.^{25,70} Similarly, mandatory iodisation of salt, which started in 1995 has eradicated gross iodine deficiency in the country.¹⁹ Close monitoring of iodine levels has in fact become a necessity in view of the very high urinary iodine levels found in some provinces.

Micronutrient supplementation

Vitamin and mineral supplementation is often necessary as a short-term intervention to address micronutrient deficiencies. The various supplementation programmes available in South Africa have limitations in terms of bio-availability, continuity of supply, quality of the composition of the supplements and compliance. The high dose vitamin A supplementation programme has had limited success as it has failed to reach the most vulnerable children and post-partum women.⁷¹ The provision of iron supplements to pregnant women through maternity and obstetric units has been criticised in terms of poor bio-availability of the iron, failure to implement the programme according to the guidelines and lack of compliance by women.^{72,73}

Hospital-based management of severe malnutrition

Although severely malnourished children are often admitted to hospital, many still die an avoidable death.⁷⁴ In South Africa, the District Health Information System (DHIS) was amended in 2006 to provide information on the case

fatality rate of severely malnourished children in hospitals. A limitation of this source of information remains the failure to identify malnutrition as a reason for admission and / or death. Available data seems to suggest that case fatality from severe malnutrition in many institutions remains seriously high (see Box 1), although it has been demonstrated to be reduced successfully through appropriate training and capacity development.

Box 1: Case study - Mount Frere

In Mount Frere, in the Eastern Cape, the two hospitals Sipetu and Mary Theresa, both had high case fatality rates for severely malnourished children (46% and 25% respectively). A project to address this high case fatality rate was implemented through the formation of a hospital nutrition team to assess the clinical management of severe malnutrition; the development and implementation of action plans to improve quality of care; and the monitoring and evaluation of activities managed to reduced case fatality rates to 21% and 18% respectively in these two hospitals.⁷⁵⁻⁷⁷

This demonstrates that even in remote rural district hospitals, staff can be trained and motivated to perform simple health research, which can assist in the improvement of clinical management and quality of care of malnourished children.

Source: Derived from multiple sources.

Nutrition rehabilitation in communities

The Nutrition Supplementation Programme (previously known as the PEM scheme) is a short-term intervention to address acute malnutrition. The utilisation of this programme has been improved, especially through increased involvement of trained nutrition professionals in the programme. However, there are still many difficulties including failure to enrol at risk children, erroneous enrolments, which deplete resources and failure to discharge children.⁶² Most important is the absence of community-based interventions, which could assist food insecure households and thus prevent the oscillation of children in and out of this programme. Here the strengthening of district agricultural support services is urgent. Similarly, it is urgent to extend coverage of the Child Support Grant to the families of malnourished children through enrolling every child who has been identified as malnourished in hospitals and through growth monitoring in clinics and health centres. The distribution of infant formula by health services remains contentious as community members may perceive it as a condonement of the use of formula at the cost of breastfeeding promotion.

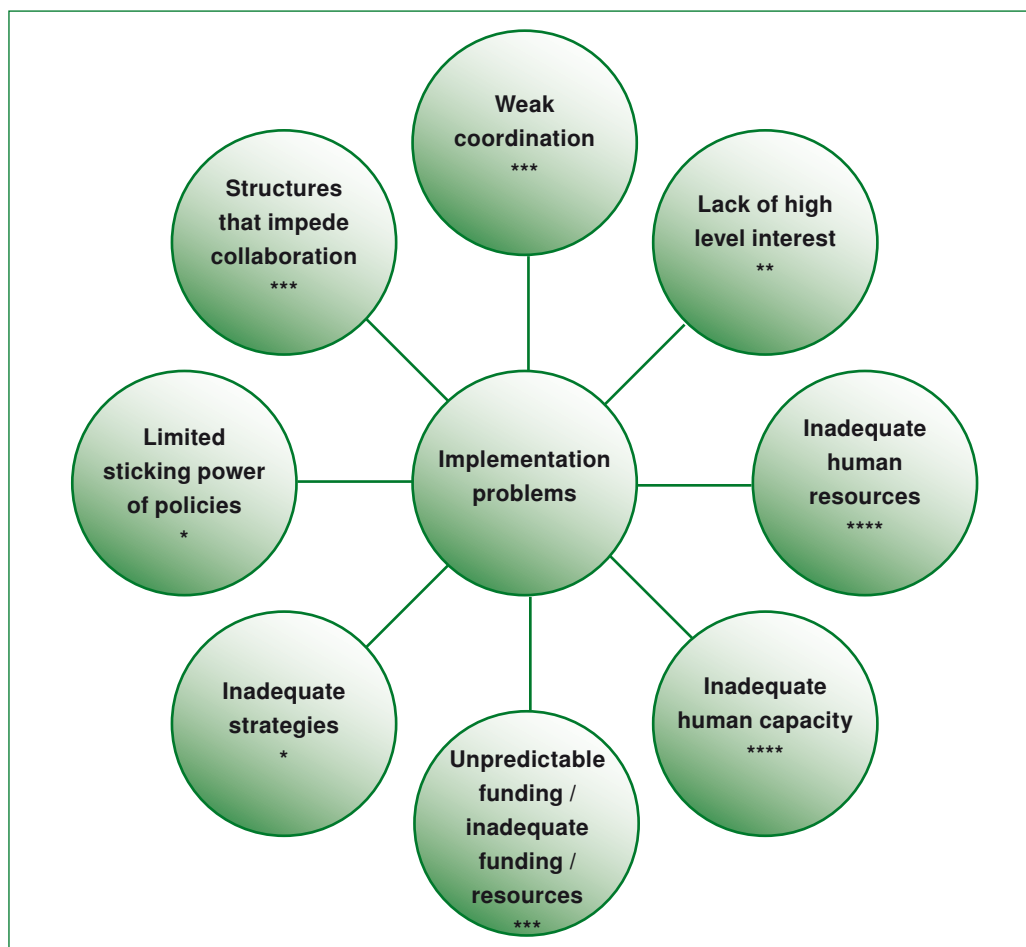
Nutrition management during illness (specifically diarrhoeal disease)

The IMCI was adopted by the DoH in 1997 and implemented in all provinces.⁷⁸ The IMCI aims to reduce child mortality and morbidity in developing countries by combining improved management of common childhood illnesses with proper nutrition and immunisation.⁷⁹ However, IMCI guidelines and handbooks are not detailed enough on the specifics of the nutritional and feeding guidance to be given to mothers of sick children.⁸⁰ This is crucial as the majority of sick children are not seen by nutrition specialists (at least not during the first couple of contacts), but by other health workers such as nurses. Similarly the DoH's 'Infant and young child feeding policy' promotes breastfeeding; but other than a statement on "*age-appropriate meals should be provided for children*" it is silent on other aspects of feeding of children during illness, such as continuation of feeding, and feeding additional energy-dense foods during recovery to ensure catch-up growth.⁸¹

Challenges and the way forward

South African nutrition strategies and programmes are in line with current international recommendations.^{82,83} The limited success in improving the nutrition situation in South Africa is therefore not due to inappropriate policies and strategies or lack of knowledge about relevant solutions. It would appear that inadequate implementation is the major contributor to the current situation. Inadequate implementation is not unique to South Africa.⁸⁴⁻⁸⁶ Unpacking the problem of implementation suggests a number of possible reasons and therefore possible approaches to finding solutions. A summary of key factors contributing to implementation problems is provided in Figure 4.

The core problems reducing the effectiveness of nutrition strategies in South Africa are highlighted, with recommendations for ways to address them. These contributing factors require improving a range of capacities such as technical, operational, programme / action research, information management and strategic capacity. The interrelatedness and interdependence of these broad categories are demonstrated repeatedly in Box 2.

Figure 4: Core problems reducing the effectiveness of nutrition strategies in South Africa

Note: **** significant contributor, *** moderate contributor, ** contributor, *possible contributor

Source: Adapted from Morris et al., 2008.⁸⁵

Box 2: Recommendation for implementation of nutrition strategies and programmes

Key message: Do the right things.

The South African nutrition strategy and programmes are based on international best practice. However, the context (e.g. urban or rural setting), the nature of the nutrition problem(s) and the resources available will determine the priorities in particular localities. Given limited resources, it is necessary to set priorities and sequence activities.⁸⁵ In reality, the effectiveness of interventions is relative to the specific context and the intensity of inputs. Apart from the technical knowledge on relevant nutrition interventions, knowledge of the most effective and important interventions will help focus nutrition personnel.

Key message: Do more of the right things.

Once a programme has been proven to work on a limited scale, it needs to be scaled up to improve coverage of the vulnerable population. Inadequate coverage does apply to some of the programmes in South Africa such as the different vitamin and mineral supplementation programmes (e.g. vitamin A and zinc for children, and iron and folate for pregnant women). Options and processes for scaling up should therefore be investigated. For South Africa, addressing this aspect will require additional human resources, including the cadre of community health workers, training and capacity development of nutrition specific personnel, as well as personnel at the community interface, such as nursing staff and community health workers.

Key message: Do the right things better.

This requires attention to the quality of services provided by nutrition specific personnel, as well as personnel at the community interface such as nursing staff and community health workers, and setting realistic targets. The overestimation of the possible impact of nutrition interventions, at a national level, creates unrealistic expectations and a perception of failure with subsequent negative implications for political will and support.⁸⁷

Key message: Develop strategic capacity at national and provincial level of the Nutrition Directorate.

This strategic capacity refers to the human and institutional capacity required to broker agreements, respond to challenges and opportunities, build relationships between nutrition actors and undertake strategic communication with varied audiences, to name a few.⁸⁴ The purpose of such actions will be to establish political will, ensure institutional arrangements and cooperative agreements between all stakeholders, and to secure operational capacity for acting at scale. It is clear that the development of strategic capacity at national, as well as provincial level is required to positively impact on the implementation of all nutrition relevant strategies in South Africa.

Key message: Develop capacity at all levels to manage change. Do active nutrition advocacy. Strengthen intersectoral and interprofessional collaboration.

McLachlan and Garrett argue that although the aforementioned strategies are important, “*more of the same is not enough*” and suggest that capacity development must go beyond improved technical capacity.⁸⁶ Within the South African scenario this will require capacity development at all levels and in all sectors, including the strengthening of intersectoral and multi-professional collaboration, as much of the critical nutrition relevant work is performed by health workers (including community health workers) who have no or limited nutrition specific training. Advocacy for the strengthening of community based interventions and other safety nets that impacts on nutrition, such as child support grants and early childhood development, should also be done by nutrition specific personnel.

Key message: Develop technical capacity through appropriate pre-service and in-service training of designated nutrition personnel, as well as health personnel and human resources of related services.

In South Africa, shortage of appropriately skilled personnel hampers all levels of implementation.⁸⁵ Planning for scaling up of interventions often does not factor in the number of the different categories of personnel required to ensure that effectiveness is maintained. Thailand is an example where coverage was dramatically improved following massive expansion of human resources (numbers and skills) especially at the community level (one volunteer: 20 children and one supervisor: 24 volunteers).⁸⁸

As human resources and capacity development has been identified as a significant contributor to the lower effectiveness of implementation of the nutrition strategy in South Africa, an attempt is made below to highlight possibilities for capacity development and training that may contribute to improvement of the situation. It is suggested that capacity development should follow a two pronged approach focusing on existing staff (in service) and future staff (in training). Components of a proposed capacity development strategy for the Nutrition Directorate are presented below. In addition, the human resource plan for nutrition specific professionals such as dietitians and nutritionists needs to be reconsidered, extended and implemented to ensure sufficient numbers of adequately trained professionals within the service.

♦ For the **health sector** (medical doctors, nurses, dietitians, nutritionists, community health workers)

In service:

- clearly identify priority nutrition relevant actions (e.g. breastfeeding promotion, growth monitoring and promotion);
- develop specific nutrition messages and guidelines for each of these priority areas;
- train all health workers working within these areas using the specific nutrition messages and / or guidelines;
- ensure ongoing training so that staff turnover does not undermine achievements;
- monitor the performance of staff closely to ensure adherence to the guidelines and provide continued supportive supervision;
- provide skills to manage change; and
- provide strategic capacity development to senior and middle management.

In training:

- seek collaboration with training institutions involved in training of relevant categories of health workers such as medical doctors, nurses, dietitians and nutritionists, as well as professional boards;
- communicate the technical information (detailed messages and guidelines) to ensure adequate training of all the categories of health workers within each of these areas;
- monitor the adequacy of training of these categories;
- advocate for pro-poor approaches in the curricula; and
- advocate for the incorporation of skills to manage change.

♦ For **other workers** (social workers, lawyers, development workers, agricultural workers, workers from non-governmental organisations and community-based organisations)

In service:

- advocate on the link between nutrition and development / educability / productivity; and
- provide skills to manage change.

In training:

- advocate for the incorporation of pro-poor approaches in the training curricula; and
- advocate for the incorporation of skills to manage change.

Key message: Improve information systems.

In addition to the development of the various capacities at the different levels, adequate functional information systems will also contribute to improved implementation. It is therefore proposed that the Nutrition Directorate develop a comprehensive information plan. Most importantly, collection and utilisation of available information at provincial and district level should be a priority to ensure appropriate targeting and resource allocation towards the most needy.

Source: Developed by authors.

Conclusion and Recommendations

The nutritional status of South Africans, which is the outcome of complex multiple factors such as dietary intake, diseases, environmental quality, caring practices, food security, education and poverty, has not improved since the first democratic elections in 1994. The anthropometric status of children reflects the persistent presence of chronic mild under-nutrition, whilst the increasing coexistence of overweight in adults and adolescents (especially females) challenges dietary and physical activity choices by all age, gender and socio-economic groups. Except for optimal folate and iodine status, the biochemical micronutrient status (specifically vitamin A and iron) has deteriorated dramatically since 1994. Whilst the findings of the 2005 NFCS-FB survey needs to be scrutinised closely (especially in terms of validity and reliability), it is imperative that the micronutrient status of children in South Africa should be monitored continuously through a functional information system to evaluate the contribution of the comprehensive nutrition strategies available through the DoH's INP and other governmental agencies.

The effectiveness of these strategies appears to be sub-optimal to date. Improvement in impact will require improved implementation, which is in turn dependant on programmatic choices, the development of a range of capacities such as technical, operational, programme / action research, information management and strategic capacity as well as the provision of adequate numbers of appropriately trained human resources. It is therefore recommended that the following aspects should receive attention from the DoH.

- Match international best practice interventions to the specific nutritional problems in South Africa and modify it according to the context and available resources.
- Set realistic targets.
- Prioritisation by limiting the focus and / or variety of interventions might be necessary to ensure that the effect is not diluted by spreading resources too thinly.
- Scale interventions up once they have been proven to work. It is however essential to ensure that the scaling up is done with sufficient accompanying resources.
- Ensure adequate technical capacity by providing continuous in-service training to all relevant categories of health workers, and by influencing the pre-service training of these categories of workers.
- Develop the skill of available human resources to foster cooperation, to see multiple perspectives and to communicate strategically.

References

- 1 World Health Organization. Nutrition for health and development. Geneva: WHO; 2000.
URL: <http://www.searo.who.int/en/Section13/Section38.htm>
- 2 Administrative Committee on Coordination/Standing Committee on Nutrition. 4th Report on the world nutrition situation. Geneva: ACC/SCN in collaboration with IFPRI; 2000.
URL: <http://www.ifpri.org/pubs/books/4thrpt/4threport.pdf>
- 3 United Nations International Children's Fund. Strategies for improving the nutritional status of women and Children in developing countries. New York: UNICEF; 1990.
- 4 World Bank. Enriching lives: overcoming vitamin and mineral malnutrition in developing countries. Washington DC: World Bank; 1994.
- 5 Aguayo V. Profiles guideline: calculating the effects of malnutrition on economic productivity, health and survival. Report in preparation for workshop. Washington: Academy for Educational Development; 1999.
- 6 Department of Health. An integrated nutrition strategy for South Africa. Report of the nutrition committee to the Minister of Health. Pretoria: Department of Health; 1994.
- 7 Department of Health. Integrated Nutrition Programme for South Africa. Draft 5. Broad guidelines for implementation. Pretoria: Department of Health; 1998.
- 8 Day C, Gray A. Health and related indicators In: Ijumba P, Barron P, editors. South African Health Review 2005. Durban: Health Systems Trust; 2005.
URL: http://www.hst.org.za/uploads/files/sahr05_chapter17.pdf
- 9 United Nations Children's Fund. World Declaration on the Survival, Protection and Development of Children. 1990 [cited 2008 Aug 1].
URL: <http://www.unicef.org/wsc/declare.htm>.
- 10 Kruger HS, Swart R, Labadarios D, Dannhauser A, Nel JH. Anthropometric status. In: Labadarios D. National food consumption survey: fortification baseline: South Africa 2005. Chapter 4. Stellenbosch: Department of Health; 2007.
- 11 South African Vitamin A Consultative Group. Children aged 6 to 71 months in South Africa, 1994: their anthropometric, vitamin A, iron and immunisation coverage status. Isando: 1995.
URL: <http://www.sahealthinfo.org.za>
- 12 Labadarios D. The National Food Consumption Survey (NFCs) - children aged 1-9 years, South Africa, 1999. Stellenbosch: Department of Health; 2000.
- 13 Steyn NP, Labadarios D, Maunder E, Nel J, Lombard C. Secondary anthropometric data analysis of the national food consumption survey in South Africa: the double burden. Nutrition. 2005;21:4-13.
- 14 World Health Organization. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. Geneva: WHO; 1995.
- 15 World Health Organization. Indicators for Vitamin A deficiency and their application in monitoring and evaluating intervention programmes. WHO/Nut/96.10. Geneva: WHO; 1996.
- 16 World Health Organization. Worldwide prevalence of anaemia 1993-2005. Geneva: WHO; 2008.
- 17 Semba RD. Iodine deficiency disorders. In: Semba RD, Bloem MW, editors. Nutrition and health in developing countries. New Jersey: Humana Press; 2001. p. 393-426.
- 18 Hotz C, Brown KH. International Zinc Nutrition Consultative Group. Technical Document #1. Assessment of the risk of zinc deficiency in populations and options for its control. Food Nutr Bull. 2004;24(1):S94-203.
- 19 Jooste PL, Labadarios D, Nel H, Strydom E. Iodine content of household salt, drinking water and iodine status of women and children. In: Labadarios D. National food consumption survey: fortification baseline, Chapter 8: South Africa 2005. Stellenbosch: Department of Health; 2007.
- 20 Labadarios D, Moodie IM, Van Rensburg A. Vitamin A status. In: Labadarios D. National food consumption survey: fortification baseline, Chapter 9A: South Africa 2005. Stellenbosch: Department of Health; 2007.
- 21 Labadarios D, Louw R. Iron Status. In: Labadarios D. National food consumption survey: fortification baseline, Chapter 9B: South Africa 2005. Stellenbosch: Department of Health; 2007.
- 22 Dhansay MA, Marais CD, Labadarios D. Zinc status. In: Labadarios D. National food consumption survey: fortification baseline, Chapter 9D: South Africa 2005. Stellenbosch: Department of Health; 2007.
- 23 Department of Health. Foodstuffs, Cosmetics and Disinfectants Act (Act 54 of 1972). Regulations relating to the fortification of certain foodstuffs. Government notice no. R2003. Pretoria: Department of Health; 2003.
- 24 Department of Health. Immunisation Awareness Campaign 2001. Directorate Nutrition Fact Sheet. Vitamin A. Pretoria: Department of Health; 2001 [cited 2007 Jul 27].
URL: <http://www.doh.gov.za>
- 25 Labadarios D. Folate status. In: Labadarios D. National food consumption survey: fortification baseline, Chapter 9C: South Africa 2005. Stellenbosch: Department of Health; 2007.
- 26 World Health Organization. HIV transmission through breastfeeding: a review of available evidence. New York: UNICEF; 2004.
URL: http://www.who.int/reproductive-health/docs/hiv_infantfeeding/breastfeeding.html

- 27 Department of Health. South Africa Demographic and Health Survey 1998. Pretoria: Department of Health; 2002. URL: <http://www.doh.gov.za/facts/1998/sadhs98/>
- 28 Department of Health. South Africa Demographic and Health Survey 2003. Pretoria: Department of Health; 2007. URL: <http://www.doh.gov.za/docs/index.html>.
- 29 United Nations Children's Fund. Young lives. New York: UNICEF; 2007.
- 30 Bourne LT, Hendricks MK, Marais D, Eley B. Addressing malnutrition in young children in South Africa. Setting the national context for paediatric food-based dietary guidelines. *Matern Child Nutr.* 2007;3(4):230-38.
- 31 Department of Health, World Health Organization, United Nations Children's Fund. Integrated management of childhood illnesses: sick child age 2 months up to 5 years, South Africa. Department of Health: Pretoria; 2003.
- 32 Bourne L. South African paediatric food-based dietary guidelines. *Matern Child Nutr.* 2000;3(4):227-29.
- 33 Meyer A, Van der Spuy D, Du Plessis LM. The rationale for adopting current international breastfeeding guidelines in South Africa. *Matern Child Nutr.* 2007;3(4):271-80.
- 34 Mamabolo RL, Alberts M, Mbenyane GX, Steyn NP, Nthangeni NG, Delemarre-Van De Waal HA et. al. Feeding practices and growth of infants from birth to 12 months in the central region of the Limpopo Province of South Africa. *Nutrition.* 2004;20:327-33.
- 35 Ruhle M. Breastfeeding and weaning practices and attitudes of mothers and/or childminers of under 2-year-old children, Soshanguve. M.Sc. Dietetics dissertation. Pretoria, University of Limpopo, Medunsa campus; 1999.
- 36 MacKeown J. The Birth-to-Twenty (Bt20) Study – Nutrition. Research Brief [cited 2008 Jul 1]. URL: <http://www.mrc.ac.za/healthdevelop/nutrition.pdf>
- 37 Reddy SP, Panday S, Swart D, Jinnabhai CC, Amosun SL, James S, et al. The 1st South African national youth risk behaviour survey 2002. Cape Town: South African Medical Research Council; 2003.
- 38 Temple N, Steyn NP, Myburgh NG, Nel JH. Food items consumed by students attending schools in different socioeconomic areas in Cape Town. *Nutrition.* 2006;22(3):252-58.
- 39 World Health Organization. Preliminary results of the World Health Survey, 2002-2003; International physical activity data, South African results. Geneva: WHO, 2005 [cited 2007 Jul 27]. URL: <http://www.who.int/healthinfo/survey/whsresults/en/index1.html>
- 40 Chopra M, Steyn N, Lambert V. Decreasing the burden of cardiovascular disease. Western Cape Burden of Disease Reduction Project. Final report. Volume 6 of 7; 2007.
- 41 Groenewald P, Bradshaw D, Nojilana B, Bourne D, Nixon J, Mohamed H, et al. Cause of death and premature mortality. Cape Town: South African Medical Research Council; 2001.
- 42 Reddy KS, Yusuf S. Emerging epidemic of cardio-vascular disease in developing countries. *Circulation.* 1998;97:569-601.
- 43 Gericke GJ, Labadarios DL. A measure of hunger. In: Labadarios D. National food consumption survey: fortification baseline, Chapter 7: South Africa 2005. Stellenbosch: Department of Health; 2007.
- 44 Statistics South Africa. General Household Survey 2006. Pretoria: Statistics SA; 2007 [cited 2007 Oct 1]. URL: <http://www.statssa.gov.za>.
- 45 Department of Health. The Integrated Nutrition Programme [cited 2008 Jun 20]. 2008. URL: <http://www.doh.gov.za/docs/INP>
- 46 Labadarios D, Steyn NP, Mgijima C, Dladla N. Review of the South African nutrition policy 1994-2002 and targets for 2007: achievements and challenges. *Nutrition.* 2005;21:100-08.
- 47 Department of Social Development. Social Assistance Act. Act No 13, 2004. Government Gazette 2004; No 26446 [cited 2008 Oct 1]. URL: <http://www.sassa.gov.za/content.asp?id=1000000527>.
- 48 South African Social Security Association. Types of grants and their qualifying requirements. Pretoria: Department of Social Development [cited 2008 Jul 1]. 2008.
- 49 Alderman H, del Ninno C. Poverty Issues for zero-rating value-added tax (VAT) in South Africa. Informal discussion paper: South Africa: poverty and inequality. World Bank. 1999;19336.
- 50 World Health Organization, United Nations Children's Fund. Declaration of Alma Ata. International Conference on Primary Health Care: Alma Ata, USSR. 1978 Sept 6-12 [cited 2008 Jun 18]. URL: <http://www.who.int/management/district/phc/en>.
- 51 Department of Health. Integrated nutrition programme: strategies for the implementation of the baby friendly hospital initiative. Pretoria: Department of Health; 2001.
- 52 Hendricks MK, Goeiman H, Dhansay A. Food-based dietary guidelines and nutrition interventions for children at primary healthcare facilities in South Africa. *Matern Child Nutr.* 2007;3(4):251-58.
- 53 Hendricks MK, Eley B & Bourne L. Nutrition and HIV/AIDS in infants and children in South Africa: implications for food-based dietary guidelines. *Matern Child Nutr.* 2007;3(4):322-33.
- 54 Department of Labour. Basic Conditions of Employment Act, South Africa. Pretoria: Department of Labour; 1997.
- 55 Republic of South Africa. Unemployment Insurance Act (Act 63 of 2001). URL: <http://www.info.gov.za/gazette/acts/2001/a63-01.pdf>
- 56 Latham M. Breastfeeding and HIV: a four country study. Presented at the 17th International Congress of Nutrition. August 27-31; 2001.

- 57 Bland RM, Rollins NC, Coovadia HM, Coutsooudis A, Newell ML. Infant feeding counselling for HIV-infected and uninfected women: appropriateness of choice and practice. *Bull World Health Organ.* 2007;85(4):289-96.
- 58 Coutsooudis A, Coovadia HM, Wilfert CM. HIV, Infant feeding and more perils for poor people: new World Health Organization guidelines to encourage review of formula milk policies. *Bull World Health Organ.* 2008; 86(3):210-14.
- 59 Shah S, Rollins N & Bland R. Breastfeeding knowledge among health workers in rural South Africa. *J Trop Pediatr.* 2005;51(1):33-38.
- 60 Department of Health. The Primary Health Care package for South Africa – a set of norms and standards. Pretoria: Department of Health; 2000 [cited 2007 Sep 19]. URL: <http://www.doh.gov.za/docs/policy/norms.html>.
- 61 McDonald EL, Bailie RS, Rumbold AR, Morris PS, Paterson BA. Preventing growth faltering among Australian indigenous children: implications for policy and practice. *Med J Aust.* 2008;188(8 Suppl):S84-6.
- 62 Schoeman SE, Hendricks MK, Hatting SP, Benade AJ, Laubscher JA, Dhansay MA. The targeting of nutritionally at risk children attending a Primary Health Care facility in the Western Cape Province of South Africa. *Public Health Nutr.* 2006;9(8):1007-12.
- 63 De Villiers A, Koko-Mhlahlo, Senekal M. Nutritional well-being of young children in Duncan Village, East London, South Africa : accessibility of Primary Health Care clinics. *Public Health Nutr.* 2005;8(5):520-32.
- 64 Oelofse A, Van Raaij JM, Benade AJ, Dhansay MA, Tolboom JJ, Hautvast JG. The effect of a micronutrient-fortified complementary food on micronutrient status, growth and development of 6-12 month old disadvantaged urban South African infants. *Int J Food Sci Nutr.* 2003;54(5):399-407.
- 65 Nesamvuni AE, Vorster HH, Margetts BM, Kruger A. Fortification of maize meal improved the nutritional status of 1-3 year old African children. *Public Health Nutr.* 2001;8:461-67.
- 66 Van Stuijvenberg ME, Smuts CM, Lombard CJ, Dhansay MA. Fortifying brown bread with sodium iron EDTA, ferrous fumarate , or electrolytic iron does not affect iron status in South African schoolchildren. *J Nutr.* 2008;138(4):782-786.
- 67 Kathuria P, Lohr JW. Lead Nephropathy. *E-Medicine* 2008 [cited 2008 Oct 1]. URL: http://www.emedicine.com/med/byname/Lead_Nephropathy.htm
- 68 Norman R, Mathee A, Barnes B, Van der Merwe L, Bradshaw D. The South African Comparative Risk Assessment Collaborating Group. Estimating the burden of disease attributable to lead exposure in South Africa in 2000. *S Afr Med J.* 2007;97(7):773-80.
- 69 Faber M. Dietary intake and anthropometric status differ for aneameic and non-anaemic rural South African infants aged 6-12 months. *J Health Popul Nutr.* 2007;25(3):285-93.
- 70 Sayed A-R, Bourne D, Pattinson R, Nixon J & Henderson B. Decline in the prevalence of neural tube defects following folic acid fortication and its cost-benefit in South Africa. *Birth Defects Res A Clin Mol Teratol.* 2008;82:211-216.
- 71 Swart R, Labadarios D, Kruger S, Nel JH, Schloss I. General and socio-demographic factors impacting on nutritional status. In: Labadarios D. National food consumption survey: fortification baseline, Chapter 3: South Africa 2005. Stellenbosch: Department of Health; 2007.
- 72 Beard JL. Effectiveness and strategies of iron supplementation during pregnancy. *Am J Clin Nutr.* 2000;71(5):1288S-1294S.
- 73 Bothwell TH. Iron requirements in pregnancy and strategies to meet them. *Am J Clin Nutr.* 2000;72(1):257S-264S.
- 74 Schofield EC, Ashworth A. 1996. Why have mortality rates for severe malnutrition remained so high? *Bull World Health Organ.* 1996;74:26-51.
- 75 Puoane T, Sanders D, Chopra M, Ashworth A, Strasser S, McCoy D, et al. Evaluating the clinical management of severely malnourished children: a study of two rural district hospitals. *S Afr Med J.* 2001;91(2):137-41.
- 76 Puoane T, Sanders D, Ashworth A, Chopra M, Strasser S, McCoy D. Improving the hospital management of malnourished children by participatory research. *Int J Qual Health Care.* 2004;16(1):31-40.
- 77 Puoane T, Sanders D, Ashworth A, Nqumbela M. Training nurses to save lives of malnourished children. *Curationis.* 2006;29(1):73-8.
- 78 Shung-King M, Giese S, Hendricks M, Irlam J, Abrahams E, Guthrie T et al. Child Health. In: Ntuli A, Crisp N, Clarke E, Barron P, editors. *South African Health Review* 2000. Durban: Health Systems Trust; 2000. URL: http://www.hst.org.za/uploads/files/chapter19_00.pdf
- 79 Lambrechts T, Bryce J, Orinda V. Integrated management of childhood illnesses. A summary of first experiences. *Bull World Health Organ.* 1999;77(7):582-94.
- 80 World Health Organization. Handbook: IMCI Integrated Management of Childhood Illness. Geneva: WHO; 2005.
- 81 Department of Health. Infant and young child feeding policy. Pretoria: Department of Health; 2007 [cited 2008 Aug 1]. URL: <http://www.doh.gov.za/docs/INP>
- 82 Bhutta ZA, Ahmed T, Black RE, et al. for the Maternal and Child Undernutrition Study Group. What works? Interventions for maternal and child undernutrition and survival. *Lancet.* 2008;371(9610):417-40.
- 83 Bryce J, Coitinho D, Darnton-Hill I, Pelletier D, Pinstrip-Andersen P, for the Maternal and Child Undernutrition Study Group. Maternal and child undernutrition: effective action at national level. *Lancet.* 2008;371(9611):510-26.
- 84 Pelletier D and the Mainstream Nutrition Initiative. Commitment, consensus and strategic capacity: an evidence-based agenda. *SCN News.* 2008;36:38-43.

- 85 Morris SS, Cogill B, Uauy R.P, for the Maternal and Child Undernutrition Study Group. Maternal and child undernutrition: effective action at national level. *Lancet*. 2008;371:608-21.
- 86 McLachlan M & Garrett J. Nutrition change strategies: the new frontier. *Public Health Nutr*. 2008;11:1063-75.
- 87 Black R. Nutrition interventions that can accelerate the reduction of maternal and child undernutrition. *SCN News*. 2008;36:17-20.
- 88 Mason J, Sanders D, Musgrove P, Soekirman, Galloway R. Community Health and Nutrition Programmes. In Jamison DT, Breman JG, Measham AR, Alleyne G, Claeson M, Evans DB, et al, editors. *Disease control priorities in developing countries*. 2nd ed. Washington: Oxford University Press and the World Bank; 2006.

